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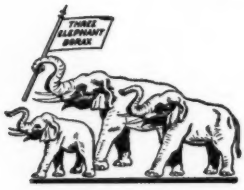

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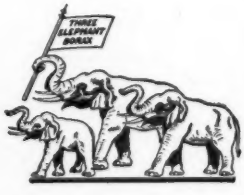

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R. H. STINCHFIELD, *Editor*

Editorial Office: 1155 16th Street, N. W., Washington, D. C.

VOLUME XXVI NUMBER 6

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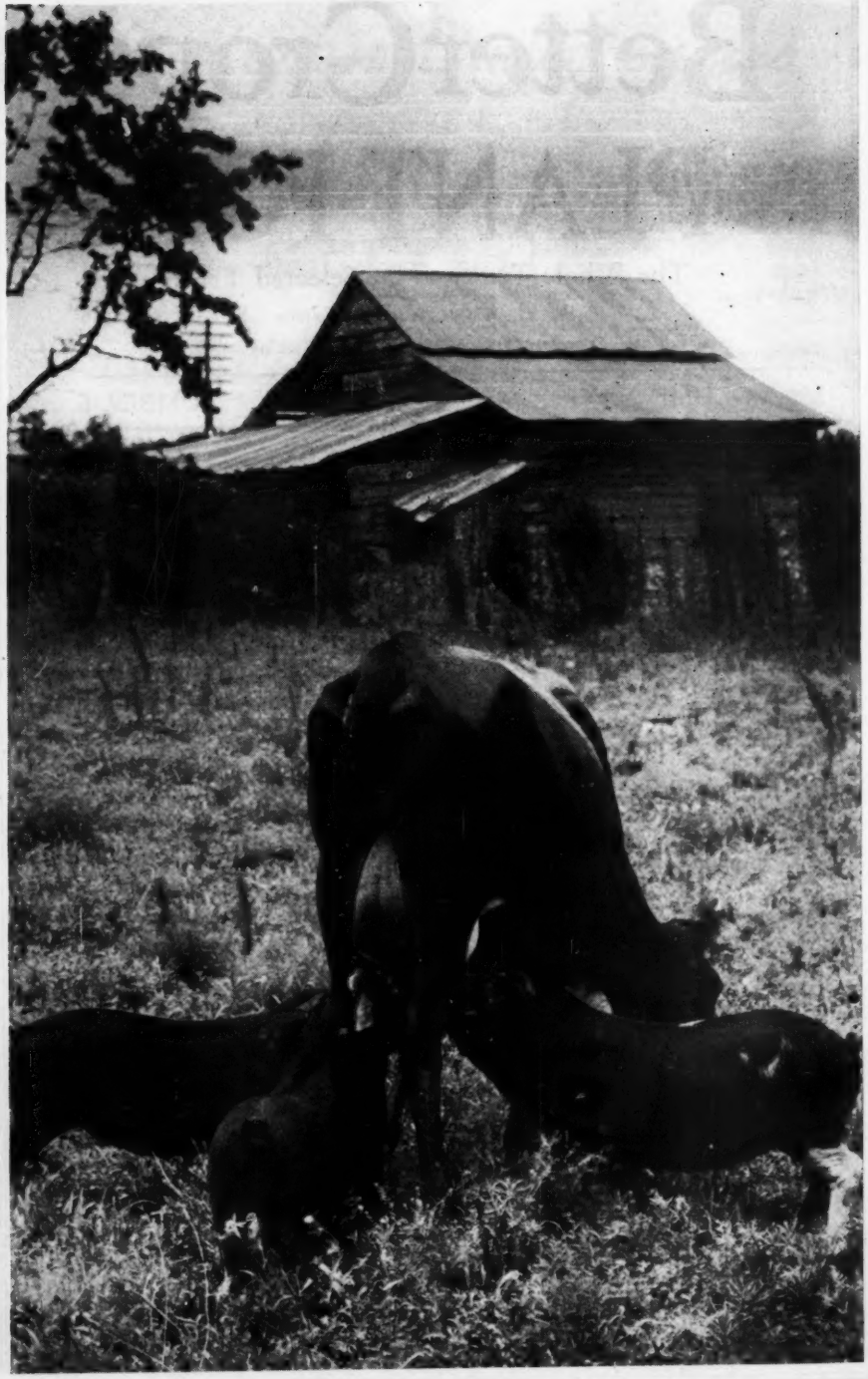

SABOTAGE!

Better Crops with PLANT FOOD

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VOL. XXVI WASHINGTON, D. C., JUNE-JULY 1942 No. 6

Patriotism and . . .

Old Glory

Jeff McDermid

WHEN they asked me to write a piece about the Flag, it sounded like it might come easy, amid all this national turmoil. Not much reason to hesitate. Look at our mutual background for it:

Yorktown, the Alamo, Gettysburg, San Juan Hill, Chateau-Thierry, Bataan, and Midway Island—battles we've read about where the banner flew over brave boys of ours!

Boy Scouts, Campfire Girls, 4-H Clubs, Y. M. C. A., Rotarians, Kiwanians, Masons—lodges our folks belonged to where the banner and the bible were equally honored!

G. A. R., D. A. R., Sons of Veterans, Veterans of Foreign Wars, American Legion—patriotic societies who have pledged the banner and tried to teach us its history!

Sunday schools, grade schools, high schools, academies, colleges—where somebody saw to it that the banner was displayed and saluted!

Hamilton's History of the Flag, Admiral Preble's Origin of the Flag, Stewart's Stars and Stripes, Hughes's Famous American Flags—familiar references all about the banner, shelved in our town library!

"Liberty Boys of '76," "Young Glory," "Yankee Doodle, the Drummer Boy," "the Red, White and Blue Weekly"—dime novel inspirations concerning the banner, perused zestfully as urchins.

"Stars and Stripes Forever," "Star Spangled Banner," and "It's a Grand Old Flag"—songs and marches we've hummed about the banner since boyhood!

Yet somehow when it comes to writ-

ing a piece about the Flag I'm awkward and diffident, like a clumsy swain trying to say the right thing to his sweetheart, of whom he feels himself unworthy. Or possibly more like a person talking about a great symbol of sacrifice, when it really hasn't cost him much to uphold it. That's when you start thinking of those poor fellows held in prison by the Japs, and from then on it sure cramps your style! It sure does, because anything you might venture to write about the Flag under such circumstances sounds hollower than a rain barrel, when all you do to prove your mettle is to hunt for scrap rubber and go without two cups of coffee.

Then a whole lot of us haven't quite got around to a sense that our Flag is a world emblem now, and the vastness and futility inherent in world-wide movements catch up with us sometimes and leave us confused. While we were growing up, you see, the Flag we talked about was a Defense Flag and an American Union Flag combined, and to wave it overseas in any but a peaceful mission was called Imperialism.

I DON'T think we need to apologize any about that sentiment either, because it hasn't a blamed thing to do with our reverence or our patriotism. Only that, like the miserable fate of our soldier boys who surrendered on Bataan, it just cramps your style, wondering how it's all going to turn out. We want Old Glory to stand for the right thing when they get to writing the peace preambles.

No siree, we don't want to live to see a time when such a bloody mess will end up in social chaos or have anybody come back at us and claim that we ought to take the "1" out of Old Glory because we yielded to expediency or greed.

However, that's just a passing idea to let you see how big a strain they put on me when they suggested I send in an essay about the Flag. But from now on I'll stick to the text and take it for granted that wherever Old Glory goes the outcome will be a "decent respect for the opinions of mankind."

As I said before, we have been conscious of the old Flag ever since our early childhood. For my part the first tenderness I developed for the banner was when I was a sort of little "mascot" for a rural G. A. R. post and used to be allowed to march with the veterans on Memorial Day and the Glorious Fourth. Last week in rummaging around I located an old print from a wet-plate negative taken of that old bunch of warriors seated on the courthouse steps away back in the Nineties. Tucked into a prominent spot between the Commander and the Color Bearer is a dim image of a kid in a velvet jacket and a rolled brim straw hat. That was the day I got blisters tramping along beside old John Blowers, who balanced the heavy silken banner in an oilcloth belt pocket and stepped off so fast you'd think he imagined Jeb Stewart's best scouts were trailing him.

I can see those old plank seats in the grove, crowded with doughty and dusty citizens, while the silver cornet band played Hail to the Chief. By the time the parade was over I was more inclined to welcome a "chef" than a chief, but sundry gulps at the town pump assuaged my vacancy until picnic lunch was ready.

When I write about the Flag and Patriotism, my memory goes back to those musty, mysterious realms of a smoky Grand Army lodge room, down three flights of broken stone steps under the county courthouse, into an anteroom with rush matting on the floor and a few card tables.

TO THE rear was the "banquet" hall that in my youthful belief was large enough and grand enough for the old Colonel's boasted regiment, including the ghosts. To the right was a thin board partition having a peephole station for the convenience of the outer and inner guards.

On privileged occasions and celebration days a few of us sons and grandsons were allowed to proceed into the

inner sanctuary without any password. Here indeed was the holy of holies for boys who read history with awe and delight. There was the altar with its crossed swords; the roll of frayed battle flags in the corner wrapped in silk and tied with braid; the pictures of heroic members who had died in uniform; the mottoes and emblems; the lithographs of generals on dashing steeds, framed in smoke and leaping ahead over stricken comrades.

I often doubt if the veterans of foreign strife bring home to us the same kind of patriotism in quite the same vintage as we imbibed so freely from the G. A. R.—and likewise in the South from the Confederate Veterans. You see, those old recruits came back from nearby battlefields, places we might some time see ourselves on relics bent. And family quarrels are more searching anyhow! I bear witness from reading the current dispatches that the boys from Texas and elsewhere must have also felt the same tugging at their hearts and received perpetual veneration for the Flag from this same old soldier shrine.

In bringing this up I am fully aware that some of the customs of those old vets did not square with the colors of the Flag. I acknowledge that we youngsters drew from them some rank ideas on the sacred protective tariff and the divine right to rule of the Republican Party. I also remember that they voted the way they "fit" and carried the "all's fair" idea home with them to use it sometimes when they got into tight places and wanted a boost. Yet above and beyond all of these human failings there remained in them a hopeful spark that kept the home fires glowing with provincial Americanism.

And so I can look back through the shimmering memory waves of many hot July celebrations to those times when as a bumptious lad I strode along the wood-block pavement trying to hold myself as erect and ramroddy as the nifty Guppy Guards, and maybe toward the end hanging onto my Father's fist lest I betray my weary stumbling. But as I recall it, the things which kept me going to the last droop were the lilting of the music and the fluttering of the Flag. And I reckon after all that's the way with most of us soldiers, young or old. The thrill and the fervor get us.

Thus reverence and sacrifice for the Flag are taught by our elders and then carried out in courageous devotion by our younger generations.

Exploits of a deathless hero like Colin Kelly and the bravery of our Army nurses over there in the South Seas recall an incident relative to the origin of the title, "Old Glory." Old as the story is to some, I believe there are many unacquainted with the beginning of this reference to our banner.

Strange to say, it all starts in Salem, that ancient little Massachusetts town, famous for its witchcraft hunting by Cotton Mather and its quaintly lovely doorposts and fireplaces designed by Architect McIntyre and his associates.

It was for long a spot where men went down to the sea in ships, and widows' watches were common on the hills and housetops. In its harbor many sloops and frigates bravely cast anchor and flew the Stars and Stripes.

Here in 1831 lived a certain Captain William Driver, master of the brig, "Charles Doggett." That spring his neighbors wanted to give him a happy

(*Turn to page* 45)

Good pasture is the key to profitable livestock management. Pasture will not remain "good" without some attention to replacing the fertility removed from the soil in meat, milk, and wool sold off the farm.

The Fertilization *of* Pastures and Legumes

By S. D. Gray

Washington, D. C.

PASTURES constitute the greatest undeveloped resource in American agriculture. They have had a profound influence on the livestock industry, the margin of profit in most phases of this industry being dependent upon the extent to which good pasture is utilized. Fertilization of good pasture to keep it good or of below average pasture to restore it to a satisfactory level of production is a wise investment on any soil suited to the growing of grass and clover.

While pasture use has contributed much to the success of livestock farming by supplying a cheap and highly nutritious feed, it has been largely at the expense of the virgin fertility of the soil. Continuous removal of the mineral plant-food elements, lime, phosphorus, and potash, in the meat, milk, and wool sold off the farm without replacement by fertilization has reduced yields and increased cost for barn feeding to a point which seriously lessens economic production.

It is estimated that our livestock population of approximately 90,000,000 animal units consumes three-fourths of the products of our improved farm land. In addition, it uses practically all of the products of the humid and arid grazing lands of all descriptions. More than one-half of the forage requirement is supplied by the 231,000,000 acres of humid grassland pastures representing

approximately one-fifth of our entire grazing area. The significance of these figures will become more apparent when we consider the carrying capacity of the grasslands and the relation of treatments to carrying capacity. On practically all of this acreage, fertility exhaustion has reached the point where some form of fertilization is now necessary. The fertilization of this large acreage to restore it to a satisfactory level of production opens up a vast new field for profitable fertilizer use.

Carrying Capacity Low

The carrying capacity of many of our pasture lands is ridiculously low. A study of the statistics on this subject reveals that on the arid and semi-arid ranges from 25 to 100 acres of land are required to support one full-grown cow or steer. In the humid regions where moisture is not a factor and where the soil fertility is still such as to support a fair growth of herbage, about five acres are required to support one animal unit. An examination of records on carrying capacity of pastures in important European countries shows that the number of acres required to carry one animal unit ranges from .91 in Belgium to 2.65 in Great Britain and Ireland. Corresponding figures from Germany, Denmark, and the Netherlands are 1.24, 1.46, and 1.60 respectively.

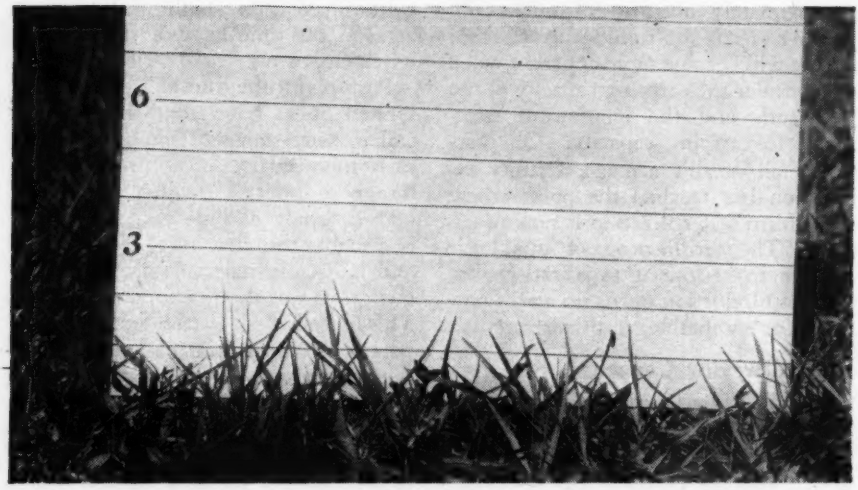
European farmers are far ahead of American farmers in the management and care of pasture lands, economic conditions and scarcity of lands for grazing having compelled them to employ a system of intensive fertilization and rotational grazing. The basic fertilizer treatment usually employed involves the use of lime every five to six years, annual applications of phosphoric acid and potash in amounts to supply approximately 50 pounds of each, and successive doses of nitrogen applied in three or four different applications supplying a total of approximately 100 pounds of nitrogen per acre per year. While this system has been highly satisfactory under American conditions wherever land values have been high or limited in acreage, the time has not yet come for its extensive use.

Pastures in the humid regions of the United States have gone through several distinct stages of impoverishment, each followed by lower production of forage of inferior quality. Depletion of the supply of lime and phosphorus is usually the first stage encountered and is usually reflected in a less vigorous growth of the grasses and legumes. This is followed by the exhaustion of potash, disappearance of legumes, and the appearance of inferior species of grasses, weeds, moss, and finally brush. In the first stages of soil fertility exhaustion, the use of phosphorus alone or with lime is likely to be sufficient to bring back the clover and through its growth help maintain the nitrogen supply. Most of our permanent pastures in the humid area probably passed the first stage of fertility exhaustion more than a generation ago. They are now, therefore, about equally deficient with respect to potash, organic matter, and nitrogen.

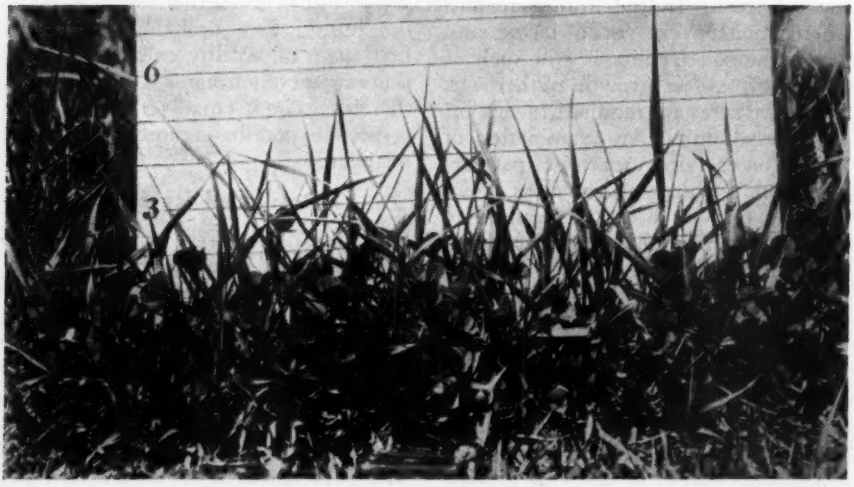
Results of Research

Results of fertilizer experiments on pastures have been on the whole impressive and clear cut. Quite generally they have emphasized the importance of liberal fertilization. While authorities are agreed that phosphoric acid is almost universally deficient and consequently the basis of any successful treatment, repeated tests have shown that it is not always a sufficient treatment. Evidence is accumulating from experimental work in widely separated areas showing that potash is frequently as necessary as phosphoric acid particularly in areas where emphasis is placed on the need for legumes in the pasture. These data have also stressed the relationships of lime to efficient utilization of phosphorus and potash.

Typical of the research findings with respect to pasture fertilization are recommendations recently emanating from the New Jersey Agricultural Experiment Station from which we quote:



An unfertilized check plot in a pasture experiment in Vermont. Note the sparseness of the herbage and lack of clover, so typical of old pastures which have received no attention for years.



This plot in the same Vermont pasture received an application of nitrogen, phosphoric acid, potash, and lime. Note the vigorous growth and the generous sprinkling of clover brought in by the potash.

"On farms with limited acreage a greater net gain to the farm might be obtained from the more intensive system of fertilizer treatment. On farms with more adequate acreage, however, the treatment with lime, phosphorus, and potash which brings in clover would be the most profitable. Perhaps the best system on many farms would be the use of heavy nitrogen fertilization balanced with lime, phosphorus, and potash on a part of the pasture for early spring grazing and the use of the straight mineral treatment, lime, phosphorus, and potash, to stimulate clover on the remainder of the farm."

A shortage of either phosphorus or potash, or both, is often a primary cause of poor clover growth, according to the Pasture Production Manual published by Mississippi State College, and where they are lacking as indicated by present

or previous crops, these minerals should be applied before reseeding old pastures or seeding new ones on depleted soil. Muriate of potash should be applied at the rate of 100 pounds per acre, and superphosphate at 200 to 400 pounds per acre, or 500 to 1,000 pounds of basic slag per acre, the manual suggests.

While the recommendations of the different experiment stations vary with respect to the fertilization of pastures, they are, generally speaking, in very close agreement on the matter of major objectives and practical management practices. Supplementing the excellent experimental programs in the several states where pastures are important are the extension demonstration programs taking the results of research direct to the farms of the Nation.

Pasture improvement demonstrations conducted in 45 counties in Indiana during 1939 developed some very interesting facts. From 26 of the demonstrations on which records were secured, results show that permanent pasture definitely responded to plant-food treatment. Phosphoric acid increased the average yield only 36%, phosphorus plus manure increased the yield 48%, phosphorus plus potash 47%, and complete fertilizer 69%. In all demonstrations lime was added where needed.

Results of 34 pasture experiments in Ohio during 1933 calculated on the basis of equivalent production per acre in pounds of beef and milk gave for the O, P, and NPK treatments respectively, 111, 203, and 389 pounds for beef and 1,080, 1,983, and 3,789 pounds for milk. In terms of cost of pasture per 100 pounds of beef and milk, the

(*Turn to page* 38)

White clover is an excellent indicator of diminishing soil fertility. Pointed out above are potash-starvation symptoms—white spots beginning around the borders of the leaf and working inward. These denote advanced stages of potash depletion in the soil.

Cotton on Sandy Soils Needs Plenty of Potash

By R. W. Wallace

Sandhill Experiment Station, Columbia, South Carolina

LONG before farmers knew anything scientific about "potash hunger," observant ones among them noticed that a "brown rust" occurred most often in sandy types of soil under certain weather conditions. The more progressive farmers found more or less by chance that less "rust" occurred when the fertilizer contained potash, an ingredient not previously considered so important or valuable on most soils strong enough for cotton production.

Potash deficiency has been found to occur more often following a dry season, as a result of insufficient moisture to replenish the supply of potash in the soil solution. The first deficiency symptoms in cotton usually occur from the middle of July to early August or after the plants have made nearly mature but somewhat diminutive growth. The symptoms first appear as a yellowish white mottling of the leaf followed by a change to a light yellowish green color with yellow spots appearing between the veins. The center tissue of these spots dies, and other numerous brown specks occur at the tip, around the margin, and between the veins of the leaf. The tip and margin of the leaf break down first, followed by a curling downward of these areas. As the physiological breakdown progresses, the remainder of the leaf finally becomes reddish brown in color, dries, and the leaf is shed prematurely. This premature shedding prevents the proper development of the bolls and, therefore, many bolls fail to open. The seed cotton from such stalks is hard to pick and the lint is inferior in quality.

In 1931 a series of experiments were started at the Sandhill Experiment Station, Columbia, South Carolina, to determine the optimum rate and time of applying potash fertilizers to cotton. These experiments have been continued on the same plots for 10 years. The supply of available plant food in the coarse, sandy soils of the sandhill area is generally known to be exceedingly low, which makes this an ideal area for the study of plant response to fertilizer treatment. Valuable data have been obtained annually from these experiments and passed on to the farmers in the sandhill region. The results have shown that potash and magnesium are very closely associated and essential in the production of cotton on sandy soils.

The manifestation of magnesium deficiency is contrasted with potash deficiency in that it is more prevalent during wet seasons. There has been a consistent increase in yields of seed cotton on these plots from applications of dolomitic limestone, and the increase has been greater as the rates of potash applied increased from 0 to 60 pounds (K_2O) per acre.

Fertilizer Applications

All plots have received an annual basic fertilizer application equivalent to 600 pounds per acre of a 5-10-0 in addition to potash as a variable before the cotton was planted, and were side-dressed with 15 pounds of nitrogen from calcium nitrate or Cal-Nitro. Potash varied at the rates of 0, 15, 30, 45, and 60 pounds per acre, making the total complete fertilizer application equivalent to 600 pounds of 7.5-10-0, 7.5-10-2.5, 7.5-10-5, 7.5-10-7.5, and

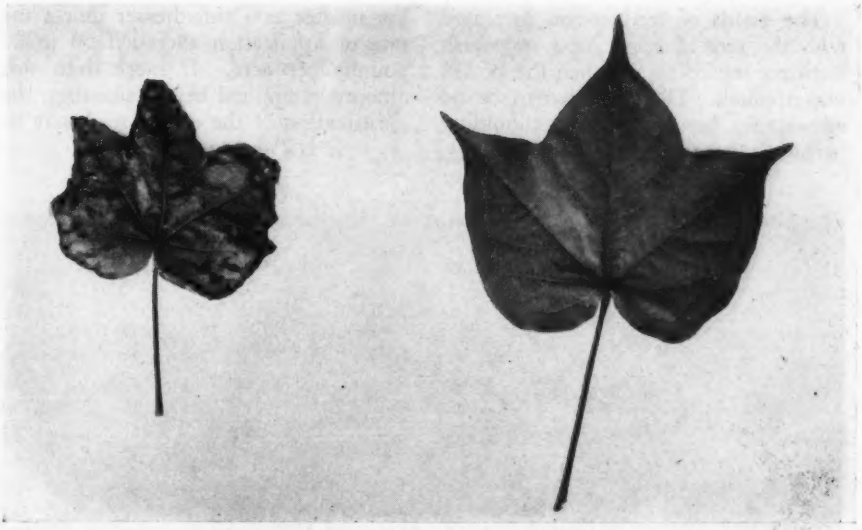


Fig. 1. Cotton leaves, from a potash-deficient plant at left and from a normal plant at right. Sandhill Experiment Station, Columbia, South Carolina.

7.5-10-10 per acre respectively. The periods of application were (1) all before planting, (2) half at planting and half at chopping, and (3) all at chopping.

No sodium nitrate was used in the fertilizer applied in this experiment, as experiments from this station have shown that where sodium salts are used in fertilizers there may not be as marked response from the use of potash fertilizer. This is because sodium may have an effect of substituting for potassium in the growth of the cotton plant.

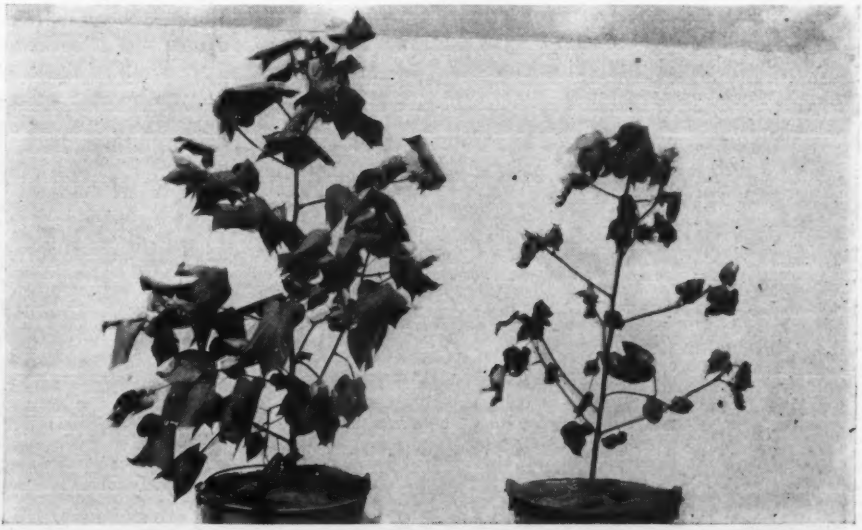


Fig. 2. Left: Normal cotton plant taken from plot which received 30 pounds of N, 60 pounds of P_2O_5, and 30 pounds of K_2O per acre before planting and was side-dressed with 15 pounds of N at chopping. Right: Potash-deficient cotton plant taken from plot which received the same treatment with the exception of no potash. Potted for photographing.

The yields of seed cotton increased with the rate of application of potash fertilizer regardless of when the potash was applied. There seemed to be no advantage, however, in withholding part of the potash at planting and applying it later as a side-dresser unless the rate of application exceeded 50 to 60 pounds per acre. If more than this amount is applied before planting, the germination of the cotton seed may be

(*Turn to page* 35)

Fig. 3. Left: Plot received 30 pounds of N, 60 pounds of P_2O_5, and 30 pounds of K_2O per acre before planting and was side-dressed with 15 pounds of N at chopping. Right: No potash. At this stage of growth (Picture taken July 1, 1940), the cotton on both plots looked fine.

Fig. 4. Left: On September 30 the cotton which received the complete treatment still looked fine and healthy; whereas, right, that which received no potash was badly "rusted."

Some Soil Problems of the Piedmont

By W. H. Garman

Associate Professor of Soils, University of Georgia, Athens, Georgia

AGRICULTURAL scientists, landowners, and land users the world over know that soil erosion is the greatest of all enemies of the agriculture upon which our civilization is founded. They have varying degrees of appreciation as to the inestimable loss of soil that has occurred, and in addition have various viewpoints with regard to the planning and effective use of an adequate system of conservation. All are aware of the decreased fertility of our soils of today; however, all may not be in complete agreement as to the fundamental reasons for this impoverishment.

Once topsoil has been removed by erosion, the most valuable portion of nature's greatest natural resource has been lost. The subsoil may contain considerable amounts of plant nutrients, but it contains practically no organic matter. It is well known that nutrient elements exist in a condition of lower availability in the subsoil than in the topsoil. Today many of our farms are what might be called subsoil farms. It is indeed fortunate that both nutrients and organic matter can be supplied in sufficient amounts to sustain plant life.

The effects resulting from the loss of organic matter from our soils are today causing all of us great concern. As they have been depleted by cultivation and erosion, soils in many instances have lost from 20 to 50% of their original crop-producing power. One has only to review the better known functions of this more or less "living" portion of the soil to understand why fertility has been so markedly affected.

Without organic matter soils lack a source of energy necessary to support the micro-organisms which are essential to the well-being of all higher forms of life. They are not capable of supplying nitrogen throughout the growing season. They lack the physical qualities without which their permeability to rainfall may be extremely limited. This means that excessive water is lost from the soil, bringing about unnecessary soil erosion. So it goes, as soils become more highly eroded they almost of necessity become more erosive.

Frequent Cause of Drought

Soils low or lacking in organic matter do not possess the capacity for holding water that may penetrate into the surface few inches during the average rainfall. This factor perhaps largely accounts for the frequent crop injury noted on Piedmont soils as the result of relatively short dry spells, which in all likelihood would have caused our grandfathers little or no concern 50 to 75 years ago. Soils depleted of organic matter lack the ability to hold ample supplies of available plant nutrients. The fixation of both phosphorus and potassium can usually be expected to be more acute in such soils. Also, the occurrence of minor element deficiencies is considerably more common in soils of low organic matter content.

Obviously, all of the desirable attributes which organic matter imparts to soils are not mentioned above. However, from those mentioned it can safely be stated that organic matter might properly be considered the "cure" of many soil "evils."

In all sections of the country many acres of desirable land have been de-

structively depleted of organic matter. In this respect the old agricultural soils of the Piedmont have suffered a very serious loss. In a study (1) of the effects of cultivation on these soils, it was found that continuously growing clean-tilled crops (for periods ranging from 45 to 150 years) decreased the organic carbon content by 56.8% and the total nitrogen content by 44.2%. This indicates that roughly one-half of the organic matter in these soils has disappeared due to cultivation.

Such a reduction in organic matter would naturally be reflected in certain changes in physical properties of the soils. As a result of physical studies on duplicate samples from 19 paired sites (representing 15 counties in the Piedmont Plateau soil province of Georgia), the following changes were found to have occurred:

Mean volume weight was increased 27.88% (from 1.137 ± 0.017 to 1.454 ± 0.015.)

Mean weight per cubic foot increased 19.78 pounds.

Mean pore space decreased 20.95% (from 57.09% ± 0.88 to 45.13% ± 0.46.)

Mean dispersion ratio (the per cent of total silt and clay in a soil which is easily dispersible) increased 63.3% (from 23.20% ± 1.90 to 37.99% ± 2.98.)

Mean maximum water-uptake capacity decreased 28.4% (from 36.22% ± 0.154 to 25.94% ± 0.100.)

Mean water-holding index (2) decreased 13.2% (from 61.3% to 53.2%).

At this point it might be stressed that the above differences are due chiefly to the effects of cultivation rather than to erosion. Samples were collected on level land to very gentle slopes where erosion had been at a minimum despite continuous cultivation. Had the average Piedmont field (which had lost approximately 50% to 75% of its topsoil) been studied, there can be little or no doubt that the above factors would have been considerably more affected. Nevertheless, considering the results obtained, it is very easy to visualize certain limitations being imposed on soil-water-air relationships by each of these factors. Considered collectively, these limitations may directly or indirectly account for the decreased inherent fertility of the average Piedmont soil of today.

Effect of Temperature

It is well known that mean annual temperature affects the decomposition of organic matter. As one travels from a region of lower temperature to one of higher temperature he encounters a lower level of organic matter, other things being equal. That this is true can be shown by comparing the above results for Piedmont soils with those of Shaulis and Merkle (3) for Pennsylvania soils. They found the mean organic carbon content of 23 forest sites in Pennsylvania to be 28,618 pounds per acre, while the mean for 19 such sites in Georgia was 20,274 pounds. Thus, under native conditions the soils of Piedmont Georgia contained 8,344 pounds per acre less carbon than the soils of Pennsylvania. In other words, there was 29% less organic matter in the more southerly location.

That cultivation has caused a greater destruction of organic matter in Georgia than in Pennsylvania can also be shown by comparing the losses of carbon under Georgia conditions with those reported by Shaulis and Merkle. They reported a mean of 18,233 pounds of organic carbon per acre in 23 clean-cultivated orchards, while the corresponding figure for 19 clean-cultivated Piedmont fields was 8,754 pounds of organic carbon, or 52% less under Georgia conditions. Thus it is evident that there has been an appre-

[1] Giddens, Joel and Garman, W. H. Some Effects of Cultivation on the Piedmont Soils of Georgia. Proc. of Soil Sc. Soc. of Amer., 1941.

[2] Water-holding index is arbitrarily defined as that per cent of the maximum weight of water absorbed from a free water surface, that remains in the soil after 48 hours of evaporation under laboratory conditions.

[3] Shaulis, N. J. and Merkle, F. G. Orchard Soil Management. Pa. Agr. Exp. Sta. Bul. 373. 1939.

ciably greater relative loss (52% less organic carbon in Piedmont soils under cultivation, and only 29% less under virgin conditions) of organic matter due to cultivation in the Piedmont soils of Georgia than in the soils of Pennsylvania.

In planning systems of conservation for states, counties, conservation regions or districts, and farms, it is natural that the best lands always be given first consideration. However, if all the land unsuitable for economical cultivation (on a long-time basis) should be retired to permanent vegetation, there is the added problem that the good land might eventually be subjected to improper management and thus destroyed more rapidly than it would otherwise. For the time being it appears more economically sound to reforest that land which is too steep to cultivate and too severely eroded to afford productive pasture and hay crops. The next class of land with respect to degree of erosion could well be put into permanent pasture and hay crops. The better lands should be carefully guarded, and only systems of cropping of known reliability be employed.

Return of Organic Matter

The system used in cropping the better lands should be one that returns to the soil adequate supplies of organic matter to prevent the deterioration of the fundamentally important physical characteristics of the soil. Without additions of organic matter soils will deteriorate in a few years, as pointed out by Jenny under Missouri conditions. He showed that in the first few years of cultivation soils lost organic matter at a very rapid rate, after which they appeared to reach a stabilized equilibrium-level, depending upon the system of agriculture employed. He further related the nitrogen content of Missouri soils to crop-producing power. He found that declining yields over a period of 60 years were associated with decreasing nitrogen content of the soil. In most Missouri upland soils of medium texture, with less than 2,000 pounds of total nitrogen per acre, the corn yield was usually under 20 bushels; while with a soil containing 3,000 to 4,000 pounds of total nitrogen, the corn yield averaged between 25 and 40 bushels per acre.

In the South it is impractical, under general agriculture, to attempt to increase organic matter to what might be considered a high level. The essential feature is that a certain amount be added to the soil at more or less regular intervals. This turn-over of organic matter appears of utmost importance, both to the soil and to the pocketbook. Such a system, to be most effective, should employ legume and grass crops extensively. It should return green manures whenever possible. The soil should be protected from beating rain and moving water throughout the greater part of the year. Such a system of agriculture would naturally mean a considerably more diversified type of farming than is now common in most sections of the South. This in itself seems highly desirable in view of the fact that the average Piedmont farm is far from being domestically self-sufficient.

If a system of true soil conservation is ever to be adopted by the Southern farmer, it is quite possible that the major obstacle to overcome will be the reduction of acres devoted to cultivated crops. As individual farm programs are planned today, they are revolved around a relatively large portion of the cultivated land area being in cotton and corn every year. To be successful from the standpoint of soil betterment and economical crop production, this acreage may have to be curtailed to the extent that the most effective cropping system devisable can be employed. In a system of soil conservation designed for local, as well as state and national improvement, the continuous growth of maximum acreages of clean-cultivated crops obviously can not permit true conservation of the soil.

Reducing the number of acres de-

(*Turn to page* 37)

Revolving sprinklers applying an inch of water every two hours. Each sprinkler covers an 80-foot circle.

Water, Fertilizer and Good Farming

By A. S. King

Extension Specialist in Soils, Oregon State College, Corvallis, Oregon

TALK ABOUT WEATHER—few places have a wetter reputation than the Willamette Valley in western Oregon. This native haunt of "Webfeet" is a land of rubber boots and raincoats, with an annual rainfall exceeding 40 inches. Water to flow away, yet the outstanding agricultural development of the past 15 years has been the development of irrigation. And there is a reason. Rain, varying in intensity from the gentle fog-like "Oregon mist" to downpours of "cat and dog" proportions, falls over this country from October through April. These months receive 90 per cent of the total rainfall. The remaining four months, May through September—the best part of the growing season—receive only 10 per cent, or a little over four inches.

In the past century, this Emerald Empire of forest and farms has developed a prosperous agriculture based on the use of this natural moisture supply, and it is still a prosperous agriculture. Nevertheless, farmers on some 50,000 acres of land have found that it can be made better with the use of irrigation during the summer season—better because they can make use of the long days of sunshine during the summer months when, otherwise, the fields are parched and brown.

The development of irrigation here might be termed unusual. There are no elabroate irrigation systems with

colossal dams and intricate canals. Public funds have not been involved. It has been a development born of individual enterprise and ingenuity, with irrigated farms scattered throughout the length and breadth of the valley between farms tilled by conventional methods. It seems a bit unusual to irrigate in an area where the annual rainfall totals between three and four feet, and that is exactly what the farm population of western Oregon used to think. When irrigation first started, it was generally looked upon as a needless waste of time, money, and energy, but experience has proved otherwise. Irrigation is now recognized as a sound practice on any crop that might grow throughout the summer months, particularly on pastures, specialty crops, and commercial vegetables. Most of the available water is now being utilized. Further expansion is dependent upon the development of additional water.

The production of vegetables for processing and for fresh market occupies about one-fourth of the Willamette Valley irrigated acreage. The grower now needs no salesmanship on the advantages of irrigation for these crops. Past experience has fully shown that the yields produced without water are too small to permit the operator to stay in business. Furthermore, the processors now insist that the vegetables be irrigated. Willamette Valley produce must be shipped a long way to market and must compete with areas where transportation costs are a relatively small item. And these Oregon irrigated products do compete on a favorable basis as shown by the impressive growth of the industry in the past few years, with exports to distant markets now measured by the millions of dollars. Processors insist on irrigation for another reason in addition to quality. Operating schedules can be maintained more easily with produce coming from irrigated farms, since crop failures are few and delays due to unseasonable dry spells do not occur.

Phenomenal Yields

Crops produced under irrigation include snap beans, carrots, beets, sweet corn, and a variety of other crops. Yields under irrigation are phenomenal and might better be left unmentioned for fear of the suspicion that this whole story is interspersed with more than a tinge of Paul Bunyanism. But we might

"It droppeth as the gentle rain from heaven upon this earth beneath"—portable revolving sprinkler on a field of Blue Lake beans which yielded over 10 tons per acre.

risk one illustration. Producers for one of the largest processing plants in Oregon average in excess of 10 tons per acre for the season with snap beans, with recorded yields in excess of 15 tons per acre. These are marketed beans of the better grades. Oregon is so far from market that cull beans have no sale value.

Most vegetables are irrigated by individually owned and operated irrigation systems. Wells and streams are the major sources of water supply. The resourcefulness and originality of these irrigators are reflected in the wide variety of equipment used, as diverse in appearance as ladies' hats and used with results almost as attractive. Water is applied not only by conventional furrow or rill systems but also by a wide variety of sprinkler equipment. Because of the rough topography and porous nature of much of the better land, most of the vegetables are irrigated by some type of sprinkler equipment.

Centrifugal pumps are used to lift the water and to provide the necessary pressure for sprinkling. Low-pressure pumps are used for surface methods and higher-pressure pumps are used with sprinkler systems, the type of pump depending on the type of sprinkler used. Electricity is the most popular and the most economical source of power, but farm tractors and old automobile engines are also widely used.

The first sprinkler systems in this area used overhead nozzle lines, locally known as the "Skinner" system. Water was sprayed through stationary nozzles placed at regular intervals along the pipe line. These pipes were carried across the field on posts at an elevation high enough to be above the crop irrigated. As the water was sprayed, the pipes were rotated back and forth either by hand or by a mechanical oscillating device. At the present time, the revolving sprinkler method of irrigation is most popular, utilizing sprinklers that spread the water in a circle 70 to 100 feet in diameter. Some of these are used in connection with permanent piping systems, with underground lines, permitting the spacing of standpipes to cover the entire field. With this system, only the sprinklers need be moved. Revolving sprinklers are much more generally used in connection with portable pipe lines. On these systems light-

Each one of these "punctured pineapples" throws the water in a square 40 x 40 feet, operating at 15 pounds pressure. The crop is strawberries, which also like irrigation.

weight steel pipes, varying in diameter from 1½ up to 6 or 8 inches, depending on the amount of water used, are laid in a temporary position across the land to be irrigated. This pipe is equipped with quick couplings that permit the pipe to be joined together or taken apart instantly. Sprinklers are spaced along a portable line, usually every 40 feet or every two lengths of pipe. This will ordinarily irrigate a strip 60 feet wide. When the irrigation is completed, the line is moved.

Recent developments gaining in popularity include sprinkling with perforated pipe, a type of irrigation in which water is applied through holes drilled directly in lightweight pipe. It requires less power but slightly more labor than the revolving type. Stationary sprinklers that throw the water in a square pattern are also available. These sprinklers are located on movable pipe lines much like the revolving sprinklers.

Individual Equipment Varies

Usually, the choice of equipment used depends on more than the personal whim of the farm operator. Each type of irrigation fits a particular need. Economical operation depends on getting the right pump, power plant, pipe, and sprinkler to fit each individual job.

Willamette Valley irrigators are affected by the war emergency. Vegetable producers are asked for more of these vitamin-packed foods that, when produced under irrigation, are tasty as well as healthful. Processors are planning to increase their packs, which, in turn, calls for increased acreages on the part of growers. The acreage could be doubled or trebled without much difficulty if the selfsame war emergency did not impose definite limitations. There are shortages of cans, processing equipment, building material, and labor which limit plant capacity to only a small increase over a record pack in 1941. The war also affects expansion of irrigation back on the farm.

Most growers are already using their irrigation equipment to capacity. New equipment requires steel, iron, copper, rubber, and other materials vital to the war effort. Equipment is not so plentiful as before the emergency, but because of the importance of irrigated products the War Production Board has granted growers a preferential priority for irrigation equipment so that some expansion is possible.

To conserve on equipment, more new land is being irrigated by surface methods which require a minimum of equipment. Where sprinkler systems are used, the sprinklers can be equipped with larger nozzles to permit the application of more water with less pipe and fewer sprinklers. An extreme shortage of electrical equipment makes it necessary to use more gasoline engines for power. An increased diversity of crops permits covering more land with the same amount of equipment. Whenever the entire acreage is devoted to one crop, the entire area needs water at the same time. With several crops the requirements are staggered, permitting the coverage of more land with the same equipment through longer hours of operation, and a 24-hour-a-day operation, 7 days per week, is not uncommon in this area.

The amount of water required will depend on the crop grown. Most vegetable growers will apply from 6 to 20 inches of water to their crop during the season. The total amount used is not so important as getting the right amount of water on the crop at critical times. Usually two or three inches of water will be applied at each irrigation. The experienced grower never lets his crop slow down for lack of moisture. He knows that a shortage of moisture at any critical period in its growth is reflected in a reduced yield and, of even greater importance, in a serious reduction in quality.

Crops cannot grow on water alone. With irrigation an intensive program of soil fertility must be followed to obtain satisfactory yields of quality produce. An ample moisture supply makes

(*Turn to page* 41)

A Comparison of Boron Deficiency Symptoms and Potato Leafhopper Injury on Alfalfa[1] . . . . .

By W. E. Colwell and Charles Lincoln

Cornell University, Ithaca, N. Y.

A YELLOWING of alfalfa caused by the potato leafhopper, *Empoasca fabae*, was described in 1927 (4)[2] and since that time several papers have dealt with the nature of this injury (1, 2, 3, 6, 7). In describing the yellowing, Granovsky (2) placed emphasis on the striated discoloration of the areas between the lateral veins. He also reported a shortening of the internodes of the new growth, and rosetting of the new shoots.

Boron deficiency symptoms on alfalfa were recognized some 10 years later (5, 8) and in the description of McLarty, Wilcox, and Woodbridge (5), there was emphasized a uniform yellowing and (or) bronzing over the intercostal area of the terminal leaves, a shortening of the internodes, and death of the growing points.

The leafhopper symptoms were described before boron deficiency was known to be a problem, and the symptoms due to a lack of boron were described either in the absence of leafhopper injury or without recognizing it as contributing to the abnormality. Since the existing descriptions are not adequate to differentiate clearly between the two types of injury, a comparison of these symptoms has been made in the greenhouse and under field conditions in New York where both agencies contribute to alfalfa yellowing.

Experimental

GREENHOUSE STUDIES

The general plan of the greenhouse investigation was to infest healthy alfalfa cultures with leafhoppers and to compare these symptoms with those caused by a deficiency of boron under similar conditions.

Forty 2-gallon stone jars containing two or three 18-month-old plants growing in a subsurface sample of Dunkirk sandy loam which was deficient in boron were used as a source of material.[3] To 20 of these, boric acid to supply 0.046 p.p.m. B (dry weight basis) was added on April 14, 1941. The 20 remaining pots received no added boron. All plants were clipped on April 14. On May 19, six of the boron-treated jars and two of the minus boron jars were each caged and infested with 25 nymphs and 10 adults of the potato leafhopper.

Complete nutrient solution minus boron was supplied to all cultures, and distilled water was used to maintain moisture. They were placed in the regular greenhouse, receiving only natural light. On June 2, final observations were made. Symptoms of boron deficiency and leafhopper injury were each obtained in the absence of the other.

The results of this comparison are presented with those of the field investigations.

[1] Reprinted from JOURNAL OF THE AMERICAN SOCIETY OF AGRONOMY, Vol. 34, No. 5, May 1942.

[2] Figures in parentheses refer to "Literature Cited."

[3] Acknowledgment is made to Prof. J. K. Wilson who donated these cultures which he had used for other work prior to this time.

PLATE 1

A, leafhopper injury in which the reddening is the main type of discoloration. Hopper infested cage, boron plot at the Belleville station. B, severe leafhopper injury, Jefferson County. C, left, leafhopper injury; center, healthy; right, boron deficiency. Greenhouse test. D, boron deficiency showing pronounced rosetting and death of the terminals with little or no yellowing. Greenhouse test. E, severe boron deficiency. Uninfested cage in untreated area at the Belleville station. F, left, an advanced stage of boron deficiency, the lower side of several leaflets are red; right, a moderate stage. Monroe County demonstration.

Field Investigations

A further comparison was made in the field during the summer of 1941 at two locations in north central New York, one station designated as Belleville, the other as Lowville. In October, 1940, borax at the rate of 40 pounds per acre was added to an area 20 by 40 feet in a field which, in each case, had been cut for hay only one year. The response to borax was in each case a mild one, but more definite at the first-mentioned station.

During the second crop in 1941, there were set up at each station four aster cloth cages, the dimensions of which were 4 by 4 by 2 feet. Two were set on the borax plot and two in the adjacent untreated area. One of each was infested with 500 leafhoppers, adults and large nymphs. Caging the plants did not noticeably affect growth.

At the Belleville station the natural leafhopper population was low (around 75 per 100 sweeps), but the two uninfested cages were dusted with impregnated pyrethrum to insure their being leafhopper free. At the Lowville station the natural population was still lower (around 30 per 100 sweeps), and the two uninfested cages were not dusted. Infestations were made at the Belleville station on August 5 and at the Lowville station on July 31. At each location the alfalfa was about 12 inches high and growing luxuriantly. At this time there was no visible response to the added borax.

Semi-weekly observations were made, but the cages were left undisturbed until August 26 when they were removed for the final observations.

Results

As a result of these studies, the following differences between the two types of injury were found to exist. The source of information, greenhouse or field, will be apparent in each case by reference to the various figures.

Type of Discoloration

Yellowing.—The *type* of yellowing alone is not adequate as a means of differentiation, although there is some tendency for the leafhopper yellowing to be characterized by a streaked appearance in which the veins and mesophyll adjacent to them remain green (Plate I, C). Leafhopper yellowing often takes place at the distal portion of the leaflet as a "V" in which the apex represents the point of feeding,[4] and the sides are bounded by veins extending to the edge of the leaflet. (See certain lower leaflets in Plate I, B.) In other cases the yellowing is more uniform (Plate I, C) and from this standpoint alone cannot be differentiated from the uniform yellowing of boron deficiency (Plate I, E and F). There may be a pronounced boron deficiency with little or no yellowing (Plate I, D).

Reddening or bronzing.—Leafhopper reddening occurs either in a "V" as described above (Plate I, A, upper left) or as a uniform discoloration of the entire leaflet (Plate I, B, right). This latter type is difficult to differentiate from boron reddening. In general, the leafhopper reddening tends to have more of a purplish cast, but this is not always true. Boron reddening is believed to represent an alternative symptom, not necessarily a more advanced stage. In New York, yellowing is the more common symptom, but both may occur even on the same leaflet. Many times, though not always, those leaves which are yellow on the upper side may be red underneath. This was true of the severely deficient specimen in Plate I, F.

Distribution of Discoloration

This is one of the most valuable criteria for distinguishing between the two types of injury. The leaves injured by leafhoppers occur at various heights on a given shoot, whereas the yellowing or reddening caused by boron deficiency is always confined to terminals. Lateral terminals may be affected, and, under these conditions, yellowing is obviously not confined to the top of the plant (Plate I, E). (*Turn to page* 44)

[4] The observation of punctures at the points of feeding is not reliable as a method for field diagnosis.

PICTORIAL

FARM LABOR SHORTAGE IS MAKING "MEN" OUT OF ALL "HANDS" AVAILABLE.

On the Spot "Shots" from

the American Home Front

Above: **Transportation is proving no problem to this young farmer.**

Below: **In the "good old days" before gas and rubber worries.**

The Editors Talk

A Farmer's Wartime Creed

In a recent issue of the Tennessee Farm and Home News, we noted "A Farmer's Wartime Creed" which was prepared by H. C. Holmes of the State's Agricultural Extension Service. This creed embodies so much of what is being asked of and given by farmers as their contribution to the war effort, and says it so concisely, that we are presenting the text in full in the hope that others may find in it phrased ideas of value to them in their work.

We are at war. We did not want it. We love peace. We want to live as God would have us live. We love freedom, freedom of action, freedom of thought, freedom of soul for ourselves and for our children and our children's children. To keep and preserve that freedom and that way of living, we know that we must fight, and fight we will.

We know that we can't all take a gun and face the enemy on the field of battle. Some must provide the food, the clothing, the implements of war. This task is no less important, for without these things we cannot win the freedom and the way of living we hold so dear.

To preserve these things, to prove my faith, to support my sons, my brothers, and my friends who are daily giving their lives for this cause—

1. I WILL produce and save every possible pound of food and feed, knowing that in so providing for my family and my stock I am releasing necessary foods for our armed forces, the workers in war industries, and our allies who are unable to produce.
2. I WILL use all my skill, energy, and land resources to help meet the needs of my community, my country, and its allies for food products by producing a surplus for market, realizing that food is as essential as bullets and that it is my privilege to be able to make this contribution.
3. I WILL save everything and waste nothing. I know that time is precious. Food stuff, feed, clothing, seed, machinery, fertilizer, rubber, scrap iron, paper—all are essential. I will practice good judgment, I will economize; I will be thrifty.
4. I WILL strive for more efficient production of all farm products. I will give that extra care needed to save my pigs, my chicks; that extra effort to secure the last half pint of milk; that extra pound of seed. I will constantly be on guard to prevent disease, insect damage, and accidents.
5. I WILL cooperate with my neighbors in the exchange of labor and equipment; join with them in hauling to and from market when one

trip can accomplish the work of two. I will share whatever I can that is needed, for I know that by helping each other we help ourselves.

6. I WILL pay all the debts I can. I will get my farm business in as good shape as possible. I will save for the future. I will buy war bonds and stamps for I want more shares in America.
7. I WILL cooperate with my church. I will put aside selfishness, petty jealousies, and greed. I will search within myself for those values worth fighting for, for I know that from the wreckage of a war-torn world such values must rise if our fight is not to be in vain.
8. I WILL encourage, aid, foster, and by every means work for community betterment. I will support my school, 4-H club, and community organization in all their worth-while undertakings.
9. I WILL instill the ideals of democracy in the minds of my children; fairness, tolerance, industry, and thrift, for I know that in a lasting peace, hate and injustice can have no part.
10. I WILL be no party to idle rumor, gossip, defeatism. I will be strong, resolute, immovable in my stand. I will remain unconquerable as an individual citizen of an unconquerable nation. I will do my part and more.

The Three Essentials

In all probability, after more than six months of our active participation in this war, there are not many people in this country who do not realize that with men, equipment, and food the three prime essentials of a concerted war effort, farming is more than "a way of life." The broad intelligence and specialized skills of the successful farmer are being recognized and appreciated along with outstanding performance among our armed forces and unprecedented production in munition factories. We haven't seen any public proposals for medals or awards of merits for farmers who are going "all-out" in their war effort, but it is not unlikely that with this year's harvest in, some suitable citations will be made.

In the meantime it is well for everyone connected with crop and livestock production to know within himself that his is no small part in the achievement of an early victory and that the more he puts into it, the greater his help. Removed from scenes of intense activity, the farm individual may have a feeling that he is not contributing much to the emergency. This feeling should be counteracted, particularly in the case of the younger man eager to go into armed service, whom the draft board exempts because he is vital to a successful farm front. There should be a satisfaction in the fact that not only is his work becoming increasingly important, but that it is being widely honored.

"For the long pull, food is as essential a weapon in this war as ships, planes, and tanks," declared Secretary of Agriculture Claude R. Wickard in an address before the Federal-State Conference on War Restrictions held in Washington, D. C., early in May. "I'm sure," he went on to say, "that everyone in this group feels just as strongly as I do about the importance of food and other farm products in making victorious war. But I wonder if all of us realize what a huge job we are up against in undertaking to supply Food for Freedom. There are recent developments which bring out more clearly than ever the great urgency of increasing and speeding the flow of farm products. That's our main concern here in the Department of Agriculture, and each day the necessity for all-out effort becomes plainer."

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture, the State Experiment Stations, and Canada, relating to Fertilisers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

¶ R. H. Bray has made some changes in the rapid tests he has devised for determining available phosphate and potash in soils. The phosphate test is described by him in Illinois Experiment Station mimeographed pamphlet AG-1028, "Rapid Tests for Measuring and Differentiating Between the Adsorbed and Acid-soluble Forms of Phosphate in Soils." It is well known that the phosphate in the soil may be present in several different forms, not all of which are of equal availability to the growing plant. The testing method previously used frequently would not appear to distinguish closely enough among the various forms present, and consequently the crop response did not always correlate well with the results of the test.

Bray has modified his extracting solution so that he thinks he can estimate much more accurately than in the past the relative amounts of the different forms of phosphate present. In order to remove the adsorbed phosphate, the author uses either a neutral or weak acid solution of ammonium fluoride. This removes what he calls adsorbed phosphate which probably is the most available form present other than the small amounts of water-soluble phosphate that, of course, are always removed by any of the methods used. In order to determine the amount of what might be termed the next lower range of available phosphate, Bray makes a second extraction on another sample of the same soil, using this time a stronger acid solution of ammonium fluoride. The acid used in each case is hydrochloric acid. Rather complete directions on preparing and conducting the tests are given. The author also makes suggestions on the interpretation of the test, although he makes it clear that the results must always be correlated with local conditions.

The potash test is described in Illinois Experiment Station mimeographed pamphlet AG1033, "Directions for Modified Test for Replaceable Potassium in Soils." According to Bray, the advantage of this test lies in the fact that the solutions used will keep for a much longer period of time than solutions previously used, less glassware is required, and the test is more easily manipulated. The replaceable potassium is that which is considered to be a measure of the available potassium, and this is determined by leaching the soil with a neutral solution of sodium nitrate. The potassium is then determined by the cobaltinitrite turbidity method. Complete directions for preparing solutions and conducting the tests and precautions with reference to the necessity of having the soil air dry before running the test and for using the cobaltinitrite at the proper temperature are given. These precautions should be carefully observed by anyone running these tests. Methods of reading the tests and interpretation of the results are described.

¶ Considerable interest in the growing of sweet potatoes for starch has developed in Mississippi during the last six or eight years due largely to the estab-

lishment of a sweet potato starch factory at Laurel, Mississippi. While sweet potatoes for table use have been grown extensively throughout the South, there was practically no information on growing the crop for starch purposes. W. S. Anderson has conducted a number of excellent investigations to obtain this needed information. His latest results on fertilizers have been published as Mississippi Agricultural Experiment Station Bulletin 367, "Fertilizer for Starch Sweet Potatoes." These fertilizer tests were conducted on several different soils over a period of four years. The Triumph variety was used throughout, since this is the variety used for growing starch sweet potatoes. The author points out that the results obtained with this variety cannot be applied directly to other varieties but may have some significance for them.

Varying the nitrogen content in the fertilizer had quite an influence on the yield and profit, with a tendency for the higher nitrogen application to be the most profitable unless a legume cover crop was turned under, in which case a low-nitrogen fertilizer was the most profitable. The author clears up an idea prevalent among many growers that too much vine is not favorable to good root development. He points out that this is true on late planted potatoes, but when the crop is planted early a large vine is highly desirable and is correlated with high yield. When small, poorly colored vines are noticed early in the season he recommends that extra nitrogen fertilizer be applied immediately so as to correct this difficulty. Phosphorus was of less importance than nitrogen in the opinion of the author. Results from potash were variable but the conclusion is drawn that more than the commonly used 4% potash in the fertilizer is desirable and the author recommends that from 6 to 8% be used. In a test on the influence of potash on starch content of the root there was found to be no correlation. It is pointed out that the crop was grown on a soil well supplied with potash and the effect of potash on starch formation might be much more marked if the soil is deficient in this nutrient. None of the fertilizer applications had any particular influence on the shape of the root. In drawing general conclusions and in making recommendations on a basis of this work, it is suggested that for sweet potatoes grown for starch on the average soil in Mississippi, 50 pounds each of nitrogen, phosphoric acid, and potash should be applied. About half of this nitrogen can be furnished by winter legume cover crops turned under with the remainder of the nitrogen and all of the phosphate and potash coming from a fertilizer application. It is pointed out that this plant food can be supplied by 600 pounds of an 8-8-8 or 800 pounds of 6-6-6 fertilizer or appropriate quantities of material. If a legume cover crop is turned under, the nitrogen in the fertilizer can be reduced.

¶ In order to obtain some idea as to the relative amounts of different forms of boron in soils over the country, R. R. Whetstone, W. O. Robinson, and H. G. Byers conducted a more or less systematic survey, taking samples from various parts of the country and analyzing them for boron. The results of this work are published in U. S. Department of Agriculture Technical Bulletin 797, "Boron Distribution in Soils and Related Data." To give some idea as to the relative availability of the boron, as well as total supplies, the authors made three differentiations. These are the water-soluble which unquestionably is available to plants, the phosphoric acid-soluble which is slowly available to a crop and probably represents reserves that are not immediately available to plants, and the highly insoluble forms, such as tourmaline, determined by a fusion of the soil and representing boron that is so slowly available as to be of no significance so far as any one crop is concerned but serving as a guide to the total boron reserve in the soil. Most attention was given to the acid-soluble boron and wide differences in the amounts of this form present were

found among various soils. In general the lighter soils of the Coastal Plains and the adjacent Piedmont areas were lowest in acid-soluble and usually also in total boron. The soils along the West Coast were naturally very low in acid-soluble boron, the high boron content frequently found in them being due to accumulation from irrigation water. The poorly drained soils of glacial lake outwash or till origin were much higher in boron contents. In general the more acid soils contained lower quantities of acid-soluble boron. Soils of low colloidal content were low in acid-soluble boron. The data show very markedly that the acid-soluble boron tends to be concentrated principally in the soil colloid fraction. There was no uniform relationship between total boron and acid-soluble boron, some soils having seven or eight times as much total boron as acid-soluble while other soils had practically all their boron present in an acid-soluble condition.

Water-soluble boron was determined in only a few soils. In the humid regions it tended to be somewhat higher in the surface soil than in the lower horizons. There seems to be no consistent relationship between water-soluble boron and either the acid-soluble or total boron contents. In a few samples where a boron content of crops was correlated to the boron content of the soils, the boron content of the crop tended to be lower if the acid-soluble boron in the soil was lower. Crops showing signs of boron deficiency in practically every case were lower in boron than crops not exhibiting the pathological symptoms characteristic of boron deficiency. In the case of apples, the boron content of the leaves and fruit varied considerably among varieties. Those which are known to frequently show boron deficiency symptoms when healthy tend to contain more boron than those which usually do not show boron deficiency symptoms.

On the basis of their work, the authors conclude that there are three large areas in the United States that are likely to show boron deficiency on crops. These include the Atlantic and Gulf Coasts from Maine to Texas, and extending up into eastern Canada; northern Minnesota, Wisconsin, and Michigan; and the West Coast States. The authors also conclude that natural boron toxicity is unlikely to occur except in the arid regions, and any excessive amounts applied are not at all likely to cause any permanent injury. In general it would appear as though about 10 p.p.m. of boron in the soil is the minimum that will supply sufficient readily available boron for healthy plant growth. It is pointed out, however, that this value is more or less arbitrary and would be influenced considerably by other factors such as soil acidity, lime content, kind and variety of plant grown, etc.

¶ An interesting bulletin on fertilizers has been prepared by L. C. Wheeting, E. L. Overholser and F. V. Vandecaveye. This is entitled "The Farmer's Fertilizer Handbook" and is issued as Popular Bulletin 165, of the Washington Agricultural Experiment Station. It briefly describes what fertilizers are and what they are supposed to do. The functions of nitrogen, phosphorus, potassium, calcium, sulphur, boron and zinc, the principal nutrients supplied in fertilizers, are summarized. The latter half of the bulletin contains specific recommendations for the fertilization of the principal crops grown under irrigated and non-irrigated conditions, with and without manure, and in the eastern and western parts of the State. The recommendations are made in terms of pounds of nitrogen, phosphoric acid, and potash per acre rather than in terms of fertilizer analyses. Farmers using these recommendations then are supposed to apply the analyses and rates of application of fertilizer which will most nearly supply the plant food recommended. The method of recommending pounds of plant food rather than percentages of plant food has much in its favor since, after all, the plant uses plant food in terms of pounds not per cent, and farm-

ers frequently use an analysis recommended but not the quantity recommended so that the actual pounds of plant food the experiment station recommended are not applied. It will be interesting to see whether the system of recommendations adopted by these authors will improve the situation. While it undoubtedly is sound, the system is not so easy to grasp by those who are not accustomed to working with decimals.

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"The Farmer's Fertilizer Handbook," Agr. Exp. Sta., Pullman, Wash., Pop. Bul. 165, Jan. 1942, L. C. Wheeting, E. L. Overholser, and S. C. Vandecaveye.

"Boron Distribution in Soils and Related Data," U. S. D. A., Washington, D. C., Tech. Bul. 797, Jan. 1942, R. R. Whetstone, W. O. Robinson, and H. G. Byers.

Soils

¶ Fertilizer interrelationships for a rotation of crops growing on a Piedmont soil are strikingly brought out in North Carolina Agricultural Experiment Station Bulletin 331, "Soil Fertility Studies in the Piedmont. I. The Effect of Limestone and Fertilizers in a 4-Year Rotation," by C. B. Williams, W. H. Rankin, and J. W. Hendricks. This is a summarization of some of the fertilizer plot work originally laid out by the senior author in 1903, although the data in this publication cover a period beginning with 1918 and running through 1934, during which period a 4-year rotation of corn, wheat, red clover, and cotton was grown with various rates and applications of nitrogen, phosphoric acid, and potash both limed and unlimed.

Lime alone increased markedly the yields of all crops with greatest effect shown on red clover. The use of nitrogen alone did not result in very much increase in yield over the untreated plot. Phosphoric acid alone gave fair increases in yield, while potash alone frequently depressed the yield under the unfertilized plot, especially on the unlimed series. In comparing the combination of any two of these elements, the phosphorus and potassium were the best combination, being particularly beneficial on clover and cotton. On wheat the nitrogen and phosphorus combination usually was best. Highest yields and profits were obtained with the complete fertilizer.

Studying the effects of the elements by omitting one of them from the complete fertilizer indicated that phosphorus was the most important, potash second in importance and nitrogen third. All crops were benefited by the addition of phosphorus to a nitrogen-potassium combination. Addition of potassium to a nitrogen-phosphorus combination also increased the yields of all crops but the greatest effects were on cotton. Nitrogen added to phosphorus and potassium also increased the yields of all crops but was most effective on wheat.

Changing the ratio of the nutrient in complete fertilizer had marked effects on the yields of the crops. Increasing the nitrogen increased the yields of all crops except clover. Triple nitrogen applications gave best results on wheat on both limed and unlimed soil, and on corn on unlimed soil, but the double normal nitrogen was best on the limed soil. The latter probably was due to the greatly stimulated clover growth due to the liming, possibly coupled with an unbalanced nutrient condition due to insufficient potassium and phosphorus where the large amount of clover was grown. Increase in the ratio of phosphoric acid in the complete fertilizer

increased yields of all crops except cotton on the limed soil where half the normal rate of phosphorus gave best results. It was observed that in all cases where larger amounts of phosphorus were used, cotton rust, indicative of potassium deficiency, was increasingly evident showing that potassium became a limiting factor. Increasing the ratio of potassium in the complete fertilizer had its greatest effects on cotton and also increased the yield of clover. It did not have much effect on wheat and corn.

Lime had a very marked effect on the crop response on this soil. Benefits from liming, however, were much greater with lower amounts of phosphate than from the higher amounts, indicating that the phosphate applications were to some extent serving the same purpose as the lime applications but probably at a higher cost. High phosphate applications relative to potash resulted in a lower response to lime, apparently due to the development of an unbalanced nutrient condition as indicated by marked potash deficiency symptoms on corn and cotton. Many other interesting and valuable facts on fertilizer usage which space does not permit giving in detail are brought out in the data presented in this bulletin.

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"Soil Survey, Story County, Iowa," U. S. D. A., Washington, D. C., Series 1936, No. 9, Nov. 1941, H. R. Meldrum, D. E. Perfect, and C. A. Mogen.

"Soil Survey, Roseau County, Minnesota," U. S. D. A., Washington, D. C., Series 1936, No. 11, Jan. 1942, P. R. McMiller, E. A. Fieger, H. Arneman, M. A. Lauffer, S. Hill, O. R. Younge, E. Kneen, A. T. Hagen, J. C. Hide, and S. Labovitz.

"Soil Survey, Puerto Rico," U. S. D. A., Washington, D. C., Series 1936, No. 8, Jan. 1942, R. C. Roberts.

Crops

¶ Alyce clover is a comparatively new crop, introduced about 30 years ago from Asia. It is finding a rather important place in Florida and other southern states where it is used as a hay, cover, and seed crop. General information on growing Alyce clover is given in Florida Agricultural Experiment Station Press Bulletin 570, "Alyce Clover," by R. E. Blaser, G. E. Ritchey, and W. B. Stokes. The crop should be grown on well-drained soils that are free of nematodes. The authors found that good stands of Alyce clover were obtained regardless of fertilizer treatment but hay yields were greatly increased by proper fertilization. On sandy soil on which the fertilizer trials were conducted phosphate and potash were very important. Omitting phosphate from the fertilizer decreased the yield considerably, while omitting potash depressed the yield almost to the same level as the unfertilized areas. In the particular test reported lime was of little benefit, but it may be needed on other soils. The general fertilizer recommendation is 200 to 400 pounds of 0-16-16 fertilizer per acre. Work so far conducted indicates that inoculation of the seed is not necessary. Other information on growing and handling the crop is briefly given in the bulletin.

¶ An excellent compilation of information and experimental data on peanuts has been made by H. O. West and published as Mississippi Experiment Station Bulletin 366 entitled "Peanut Production." This is a revision of Bulletin 341 of a similar title issued a couple of years ago. Essentially the same type of material is presented in the revision, but newer data reported since the first edition have been incorporated in the

present bulletin. The subjects covered are soil adaptation, varieties, seedbed preparation, fertilization and liming, planting, cultivation, digging, stacking, picking, marketing, use of vines for hay, insect pests and diseases, and the use of peanuts as feed on the farm. Data are quoted from numerous experiment station publications. The information on fertilizer shows why there is so much confusion in the fertilization of this crop, since the data are often contradictory or else do not show any particular trend. The bulletin is a very useful source of information on experimental work with peanuts in this country.

¶ The New Jersey Experiment Station is recommending two new types of red clover to growers in that State. Descriptions and brief cultural directions for these are given by C. S. Garrison in New Jersey Agricultural Experiment Station Circular 419, "Better Strains of Red Clover." The two strains recommended are Kentucky 101 and Cumberland. These strains can be cut for hay two years instead of the customary one year for the ordinary red clover. It is pointed out that many clover failures are due to low soil fertility and if full advantage is to be taken of these improved strains, adequate fertilization must be supplied. The small grain preceding the clover should be well fertilized with 300 pounds of fertilizer such as 3-12-6 or 5-10-10 per acre unless the land has been heavily manured, in which case superphosphate may be all that is needed to supplement the manure. After the grain crop has been harvested, a top-dressing of 200 pounds of 0-12-12 per acre should be applied on the clover; and after the first year's cutting, 400 pounds of 0-12-12 per acre should be applied in the fall in order to maintain a vigorous stand for the second-year hay crop. Lime should be applied as needed prior to seeding the small grain.

¶ With so much attention being given to vegetable and oil crops there may be a tendency to overlook the importance of maintaining efficient practices in growing our regular staple crops. Realizing the necessity of producing sufficient quantities of the longer staple upland cotton to meet the increased demand for strong yarn, agricultural authorities in North Carolina have issued North Carolina Extension Circular 258, "Cotton Growing in North Carolina." This briefly gives recommended varieties, seed treatment, crop rotation, fertilizer application, planting, insect control, and harvesting. In the fertilization of the crop attention is called to the advantage of using high analysis fertilizer and to the importance of keeping in mind that when peanuts, soybeans, clovers, and lespedeza are harvested as hay the potash content of the soil will be considerably reduced and provision should be made to supply cotton following these crops with enough potash to meet the full needs of the crop. When the hay is removed, cotton following these crops should receive 500 pounds of 4-8-8 in the Coastal Plain and a 4-10-6 in the Piedmont with 150 pounds of a 10-0-10 nitrogen-potash top-dresser in each case. Where only the seed in removed, 500 pounds of 2-8-10 with a straight nitrogen top-dresser are recommended on the Coastal Plain and 500 pounds of 2-10-6 in the Piedmont. For continuous cotton or when cotton follows corn or tobacco in rotation 500 pounds of 4-8-4 with 100 pounds of a nitrogen top-dresser are recommended for the Coastal Plain soils and the same quantity of 4-10-4 with the top-dresser for the Piedmont. On potash-deficient soils, 150 pounds of a 10-0-10 nitrogen-potash top-dresser should be used instead of the straight nitrogen top-dresser in addition to the fertilizer at planting time.

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Economics

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Cotton on Sandy Soils Needs Plenty of Potash

(*From page* 12)

affected. In that case a split application would be recommended.

The average yield for the 10 years from the plots not receiving any potash was only 543 pounds of seed cotton per acre. The difference in yield between

0 and 15 pounds of potash was 389 pounds, an increase equivalent to 71.6 per cent in favor of the 15-pound application. The increase in yields obtained from the various rates ranged from 389 pounds to 990 pounds of seed cotton per acre, equivalent to increases varying from 71.6 to 182.3 per cent over the yield from the no-potash plots. From the average yields from the 10-year test for the rates used and under the conditions prevailing, it is calculated that the addition of 1 pound of potash has increased the yield from 17 to 26 pounds of seed cotton, depending upon the rates of application.

Pictures Tell Story

Some typical normal and potash-deficient leaves and plants where potash was applied or omitted on sandy soils are shown in the accompanying photographs. All photographs were taken of plants from the same two plots in which the one on the left for ten years received 30 pounds of potash and the one on the right had received no potash. However, both plots received the same amount of nitrogen and phosphoric acid. In Fig. 1 are shown a normal leaf and a typical potash-deficient leaf. In Fig. 2 the stalk of cotton on the left was taken from a plot (potted for photographing) which received 30 pounds of K_2O annually for 10 years, and the stalk on the right was taken from a plot which had not received any potash for 10 years but had received amounts of nitrogen and phosphoric acid equal to those applied to the one on the left. Note the premature shedding of the leaves and small bolls on the stalk on the right as compared with the normal plant on the left. In Fig. 3 the plot on the left had received 30 pounds of K_2O for 10 years whereas the one on the right had had no potash. Both plots have an excellent stand and show a promising crop with no indication of a plant-food deficiency at this stage of growth which was on July 1. Figure 4 is a picture of the same plots shown in Fig. 3 but taken 91 days later on September 30. The plot on the right which had not received any potash shows a severe potash deficiency with a premature opening of the bolls and shedding of the leaves. The final comparative yields of the two plots are shown in Fig. 5.

Fig. 5. Final comparative yields told the whole story. Left: The complete treatment produced 1,280 pounds of seed cotton per acre. Right: Where potash had been omitted, the yield was only 546 pounds of seed cotton per acre. Picture taken October 15, 1940.

Some Soil Problems of the Piedmont

(*From page* 15)

voted to cotton and corn does not necessarily imply a corresponding reduction in total yields of these crops in any given area. In this system those fields, or sections of fields, not suited for clean cultivation (by virtue of slope, erosion, or other reason) would be retired to permanent vegetation. If this were carried out on a large scale, then there could and would be increased effort devoted to the better lands. This would mean that these lands would be farmed under the best management practices known for the particular locality. Such practices should, and very likely would, permit high yields and at the same time maintain fertility. It is not unlikely that the better lands on many farms, if managed properly, would produce more cotton and corn than the entire farm is now producing. Continuing on this basis, it is conceivable that most of the land not suited for these crops could be retired from cultivation without materially affecting the total yields. In fact, it is conceivable that the total yields might even be increased under such conditions, at least in certain localities. If such an increase were obtained, it would without doubt be of economic advantage to the farmer. He would have no more man-hours of labor in each acre, and would be cultivating fewer acres. His cash outlay for seed would be less; his fertilizer and limestone would be more efficiently utilized. From the standpoint of net income these factors are of paramount importance.

Returning to the subject of soil impoverishment, probably the average Southern landowner fully realizes that the history of agriculture in the South is largely responsible for the condition of his soils today. Yet, many of these same individuals continue to adhere to practices which have destroyed their soils. The economic and social factors which to a certain degree govern every cooperative accomplishment have played and are still playing a predominate role in retarding developments which might eventually lead to a desirable system of diversification which would form the foundation for a more self-sufficient agriculture.

Down through the years the South as a whole has imported a large proportion of its manufactured goods, in addition to certain essential food requirements such as beef and dairy products. To rapidly undertake the production of a large part of its own agricultural necessities would undoubtedly be to the economic disfavor of those sections of the country which have for so long enjoyed the vast Southern markets; in fact so much so that a certain amount of political and economic pressure might naturally become involved.

Depends on Diversification

Nevertheless, if there is to be a more prosperous agriculture in the South in our day, it can come only through sufficient diversification to permit preserving and restoring of soil fertility. This could possibly come about in due time through basic and scientifically sound types of predominating agriculture; however, from the viewpoint of conservation of the soil the most promising salvation within our grasp lies in the use of grass and legume cover, pasture, hay, and green manure crops.

This alone possibly suggests a livestock program, especially for the eastern cotton states. It is not unlikely that within the coming decade further steps will be made in this direction. To this end cooperation of agricultural leaders in plant breeding, soil conservation, soil fertility, plant nutrition, and animal nutrition will be essential.

It is well that we recognize it has been man alone who is responsible for the inestimable soil destruction for

which he has already undergone untold suffering. This Nation, modern, progressive, and farsighted though it is, has wrought upon itself a rate of self-destruction never before known on the face of the earth. An unwavering effort should be devoted to the "most important of all tasks," employing agricultural methods which will permit the soil, that still remains where nature placed it, to remain there continuously, and to increase its usefulness for an agriculture upon which a modern civilization can stand securely.

The Fertilization of Pastures and Legumes

(*From page 9*)

figures for the same treatments were $4.05, $2.96, and $2.71 for beef and $0.42, $0.30, and $0.28 respectively for milk. Whether calculated as per acre production or cost of pasture per 100 pounds of beef or milk, the economic returns were significantly favorable for each fertilizer treatment.

Pasture top-dressing tests on 103 farms in 15 states and the Province of Ontario were reported by the National Fertilizer Association in 1930. Average results expressed in terms of dry matter and pounds of protein per acre present one of the most convincing pictures for fertilization that has been made available. Yields from the O, P, LP, LPK, and LNPK treatments were 1,051, 1,392, 1,548, 1,850 and 2,501 pounds dry matter per acre. For the same plots the yields of crude protein per acre were 171, 235, 266, 344, and 488 pounds. On 50 of these farms where accurate records were kept, an average application of fertilizer costing $15.14 per acre returned an average net profit of $29.62, or in other words, 195% on the investment in six months. Decreased feed costs and increased milk production practically paid for the cost of the fertilizer before the unfertilized pasture was ready to graze. In the opinion of those who conducted these tests, the use of high analysis fertilizer offers the dairy farmer quicker returns than any other investment he can make.

Pastures are recognized as being the best and cheapest source of protein feed. In the young, tender stage pasture grasses contain more protein than alfalfa hay, about twice as much as mixed clover hay. Cost of this protein is about one-third as much as in purchased feed. It is quite clear from the experimental work that has been reported that both the yield of dry matter as well as the protein are greatly increased by proper fertilization.

It is well known that apart from bulk the feeding value of pastures varies in different areas. It has been shown in recent investigations, reported by Dr. J. B. Orr of Aberdeen in his book "Minerals in Pastures," that one of the most important factors in determining the feeding value is the amount of calcium, phosphorus, sodium, potassium, and chlorine present in the herbage. Some pastures may be so poor in one or the other of these elements as to be the cause of disease among grazing animals. Rickets in young animals, general unthriftiness and low producing capacity in mature animals are characteristics of mineral deficiencies most frequently observed. In considering the mineral content of a pasture in relation to its nutritive value, it is necessary to have some standard of the requirements of animals for the different minerals. In the present state of our knowledge, according to Orr, the amount of minerals found in milk affords the best available standard for growing and lactating farm animals. The following table compares the amounts of the important minerals found in the quantities of cow's milk and good pasture which yield 1,000 calories.

It will be seen that there is a fairly

COMPARISON OF MINERAL CONTENT OF GOOD PASTURE WITH THAT OF MILK
(1,000 calories contain the following amounts in grams)

	Na_2O	CaO	P_2O_5	K_2O	Cl	Nitrogen
Cow's milk	0.81	2.38	3.43	3.21	1.4	8.32
Good Pasture	0.94	3.64	2.75	11.54	3.5	10.40

close resemblance between the mineral content of good pasture and that of cow's milk. There is no natural foodstuff so well balanced in this respect as good pasture. The close correspondence of the mineral content of a good pasture to the mineral requirements of the animals is doubtless one of the most important factors in the well-known high nutritive value of pasture for promoting growth and maintaining health of animals grazing thereon.

The mineral composition of different species of plants varies quite widely. The most outstanding difference is that between legumes and grasses. Legumes as a group tend to be richer than grasses in all of the minerals, especially in calcium. Grasses, however, are relatively richer in phosphorus than legumes. It is well-known that the addition of clovers or other legumes to grasses increases the value of the grazing. This is probably due in some extent to the fact that the two together in the proper proportions make a well-balanced diet.

In a thought-provoking paper Dr. William Albrecht, University of Missouri, points out that natural prairie grasses carry a high percentage of calcium and other cations including potassium. He further points out that leached soils may be so depleted of potassium as seriously to interfere with the production of proteinaceous plants. The theory advanced by Dr. Albrecht in respect to the importance of calcium and potassium in producing plants carrying a relatively high content of nitrogen, plants such as the grasses and clover, suggests very careful consideration of their importance in any pasture fertilization program.

White clover is sometimes styled as

Jersey cows on an excellent crimson clover pasture at the Belle Mina Experiment Station in Alabama.

the key to pasture improvement. By many authorities it is regarded as an excellent indicator of mineral deficiencies. When it fails, it is a reasonably sure sign that the supply of potash, phosphorus, and/or lime is deficient. The importance of mineral plant food in increasing yield and quality of herbage as well as for the health and productive capacity of animals gives a high degree of significance to this type of fertilization. A deficiency of minerals is usually associated with deficiency of protein and absence of properties such as leafiness and succulence on which the nutritive value of pastures depends so much.

The old axiom, "take care of the legumes and the grasses will take care of themselves," is being put into practice throughout the humid areas of the United States. The big problem in this connection is quite naturally that of supplying the necessary minerals, lime, phosphorus, and potash, before planting the legume. The second most important probably is that of selecting the legume best suited to the particular soil and climatic conditions. White clover, the premier legume for growth in association with grasses, does best under cool, moist growing conditions.

In the Northeastern States ladino clover, a giant type of white clover, is receiving a great deal of attention. It is a triple-purpose crop—valuable for hay, pasture, or silage. It is distinguished from ordinary white clover by having much larger leaflets and taller stems. Owing to its more erect growth, it is able to compete with tall growing grasses and legumes. Although not so well adapted to closely grazed pasture sods as the smaller types of white clover, under favorable management and liberal mineral fertilization, ladino is permanent and produces large yields of high quality feed.

In areas that are subject to drought, such as in our Midwestern States, white clover has been largely replaced by the deeper rooted legumes, alfalfa and sweet clover. In the South and Gulf Coast

Excellent pasturage is one of the three uses which results in ladino clover being called the new triple-purpose crop.

States, a number of shallow rooted legumes have been tried out. Among the best for use in pasture mixtures have been the white Dutch and Persian clovers for wet soils and on the well-drained soils species such as the California burr, sweet clover, black medic, little hop, and Lespedeza. Of one thing we are quite sure and that is for almost every condition or section of the country where pastures need to be grown, there is a legume well suited for pasture uses. In practically all cases it has been found that these clovers are highly responsive to mineral fertilization.

No discussion of pastures would be complete without some mention of the part they play in soil conservation. As a means of protecting soil against erosion, pasture is universally recognized as the best form of land occupation except woodland. Its value for this purpose has received Nation-wide emphasis under the several programs of the Soil Conservation Service and Agricultural Adjustment Administration. Large tonnages of lime and commercial fertilizers have been used in estab-

lishing permanent pasture sods, the basis of soil conservation in many areas.

There is probably no other means of so greatly reducing the cost of production of livestock and livestock products and so greatly increasing the net farm income as through the improvement of farm pastures. The development of a satisfactory soil-fertility program for the maintenance of the fertility of pasture soils is the surest means of making pastures the greatest agricultural resource of our country. In the achievement of this objective, vast quantities of fertilizers and lime will be required.

Water, Fertilizer and Good Farming

(*From page* 19)

it possible to use heavier fertilizer applications and to use them profitably. The program should include commercial fertilizers, but they cannot be expected to do it all.

Fertilizing this year's crop of vegetables should have started two or three years ago. It is more important to build up a productive soil than it is to attempt to supply all of the plant-food needs to the growing crop. A good supply of the right type of organic matter in the soil is more important than anything else in producing a good crop of vegetables or any other crop. Decaying organic matter releases the natural supply of plant food in the soil—the cheapest source of plant nutrients. Without it, even very heavy applications of commercial fertilizers might not be effective. If the supply of active organic material is ample, mistakes made in the use of commercial materials are often automatically corrected. Organic material absorbs plant food applied to the soil and, in effect, releases it in the right amounts to supply the needs of growing crops. Applications of commercial materials that might damage or even kill the crop on a soil low in organic matter could be used to advantage on a soil with an ample supply.

There are many confusing facts and ideas regarding organic matter. Soil scientists are developing new information constantly, but still there is a dearth of clear-cut information on when the beneficial effects of organic matter occur. The word "humus" is responsible for most of the confusion. For the good of the grower, the word should be banned from usage. Apparently, humus is only one stage in the decomposition of organic material, and just when organic material becomes humus and when bacterial and chemical action progresses (or should we say deteriorates) until it becomes entirely inert, no one seems to know for sure. Who cares? As growers, let's forget that there ever was such a word and assume that organic matter is responsible for beneficial processes in the soil from the time it is first incorporated until it completely disappears. What if the value of organic material is due to the material itself, to the bacteriological processes during decay, or to a combination of both? The crop doesn't care and the grower must still resort to cover and green manure crops, barnyard manure, and other available materials. He can't buy humus by the sack.

Forms of Organic Matter

Good organic matter should decay rapidly and should be high in nitrogen, and usually any material high in nitrogen will decay rapidly. Legume cover crops and legume sod are ideal forms, and fertilizer, particularly phosphorus and sulphur carriers, may pay double dividends on these crops. Barnyard manure is ideal but is becoming increasingly hard to obtain. Non-legume cover crops and sod of non-legume crops can be improved by applications

of a nitrogen fertilizer. If this material is used at the time the sod is broken or the cover crop is turned under, non-legume material will be just as valuable as vetch, alfalfa, or other legumes. The nitrogen material is not lost; it will be available for use by the following crop.

The ideal situation for growing commercial vegetables would be to produce them on general farms where a good crop rotation could be followed—vegetables to be rotated with crops such as clover, alfalfa, and pasture. The situation would be still better if these other crops were marketed through livestock, leaving a supply of barnyard manure on the farm to furnish organic material and replace necessary purchases of commercial fertilizers.

Many of our growers are situated on acreages too small to make a rotation possible. Other means of maintaining a supply of organic material must be adopted. This should center around the consistent and constant use of cover and green manure crops. The land permanently devoted to vegetables should have the benefit of at least one good cover or green manure crop each year. Sometimes it may be possible to use more. It is good farming to seed some type of crop for green manure whenever the soil is not occupied by a salable crop. The crop to use will depend on the time available for growth. Even a 3-weeks' growth of turnips would be worth the expense of seeding and, possibly, an extra irrigation. During the winter months, all vegetable land should be protected by a winter cover crop, not only to supply organic material for the succeeding crop but to prevent wastes of plant food during the wet winter season. Vegetable land left fallow over the winter months will lose more than a season's supply of plant food through leaching.

No type of farming can use heavier applications of commercial fertilizers and use them more profitably than commercial vegetable production under irrigation. It is impossible to develop specific recommendations for each crop. Vegetables are grown on 40 or 50 different soil types in the Willamette Valley. Each of these supplies plant foods in different quantities. Each one of these types, likewise, has been subject to as many different types of farming as there are farmers, resulting in the removal of different quantities of plant food. The fertilizer that works satis-

Perforated pipe operating at 15 pounds pressure.

factorily on one farm might not perform the same on the neighboring farm. Different responses can also be noted even in different parts of the same field on the same farm.

On most vegetables it is desirable to make a basic application of a complete fertilizer — one containing nitrogen, phosphorus, and potash. The ratio of the three and the rate of application

in this manner, the fertilizer gives double returns since the yield of organic matter is increased and the commercial fertilizer is returned for use by the "money" crop.

Economies in the use of fertilizers can result from the use of machinery which applies the material close to the seed at seeding time. This avoids unnecessary losses in the soil and makes

Fertilizers make cover crops and cover crops plus fertilizers make yields of quality vegetables.

will vary with the crop and the soil. Usually two to three times more phosphorus than nitrogen will be included in the mixture. Potash will vary from an amount equal to the nitrogen to an amount equal to the phosphorus. Ratios of 1-2-1 and 1-3-1 are popular. The amounts used also will depend on the soil and crop. Applications supplying 50 to 75 pounds of nitrogen, 100 to 200 pounds of phosphorus, and 50 to 200 pounds of potash per acre often give profitable returns even on the best soils. Many growers have been able to use much heavier applications to advantage.

It is good management to apply as much of the commercial fertilizer as possible to the cover crop. Cover crops can utilize applications of nitrogen and phosphorus to advantage. When used

the fertilizer immediately available to the plant the minute it starts to grow. The initial application should include the total supply of phosphorus and potash to be used during the season, but additional supplies of nitrogen should be added during the season. These applications can be applied as side-dressings, or they can be applied through the irrigation equipment (a method especially effective with sprinkler equipment). If they are applied to the soil, the applications should be followed with an immediate irrigation.

Do you want to grow vegetables in the Willamette Valley? All you need to do is to get hold of some good land; install an efficient irrigation system and operate it to maintain the correct amount of moisture throughout the

season; provide a generous and constant supply of effective organic matter; apply ample amounts of commercial fertilizer of the correct formula at the right times; and follow carefully recommendations on varieties, cultural practices, and disease and insect control. Will you succeed? Possibly. All these must be blended by an indescribable something not taught in school and all too often not even acquired through years of experience. It's that natural "know how" or "savvy" that marks a successful vegetable grower anywhere.

A Comparison of Boron Deficiency Symptoms and Potato Leafhopper Injury on Alfalfa

(*From page* 22)

Although leafhopper yellowing is not confined to terminals but occurs well over the plant, it is not to be confused with the common leaf spot caused principally by *Pseudopeziza medicaginis*. This organism causes small, circular, dark brown spots on the lower leaves, and if sufficiently severe causes them to turn yellow and drop. There is likewise no danger of confusing leafhopper yellowing with that caused by potash deficiency or even by *Phytomonas insidiosa* (bacterial wilt) which, from a distant field view may appear somewhat similar.

Rosetting

There is always a shortening of the terminal internode in plants showing boron deficiency (Plate I, C, right, D, E, F). This rosetting may occur even in the absence of pronounced yellowing (Plate I, D, and E, right). Even in severe cases of leafhopper injury, this terminal internode is not appreciably affected (Plate I, A, B, and C, left). There may, however, be a general stunting of leafhopper-injured plants.

Death of the Terminal

The terminal bud of a boron-deficient alfalfa plant is always found to be abnormal. Dead buds may be found on shoots showing no yellowing, and in this case are sometimes associated with causes other than boron deficiency. However, even in the absence of yellowing, when the dead bud is accompanied by pronounced rosetting, true boron deficiency is represented (Plate I, D).

The terminal growth in those plants severely affected by leafhopper may be normal; in fact, blossoms are often abundant in a field supporting a rather heavy leafhopper population.

During the latter part of the growing season, boron deficiency and leafhopper injury occur in the same fields in several sections in New York. It is not uncommon to find both types of injury on the same plant and this cumulative effect is readily recognized by noting the two types of symptoms.

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Old Glory

(*From page* 5)

farewell on a perilous voyage, so they donated a hand-made banner to him for his vessel. Some claim that Cap Driver had a party aboard the vessel before she sailed and as the flag soared aloft he christened her Old Glory.

Possibly this was an echo in his memory of an old poem he had read in the Massachusetts Spy,

"A ray of bright glory now beams from afar,
The American ensign now sparkles a star."

This Flag, according to a note from Cap Driver written much later to the Essex Institute in Salem where the original Old Glory is kept, was carried by him around the world and among the icebergs and along the palm tree beaches, his constant companion and reminder of home through fair winds and foul.

THE Essex Institute got this flag in 1880 from Cap Driver's niece, Mrs. Harriet Cooke; although in 1913 it was claimed by his daughter, Mrs. Mary Roland of Denver, that she carefully kept the original flag and that the one now in the Institute is her crafty substitute for it. However this may be, the story is true enough that Old Glory waved over the coral reefs of the vast Pacific archipelago more than one hundred years ago, flying from old Cap Driver's brig, amid most thrilling circumstances.

In August of 1831, under the folds of Old Glory, Cap Driver rescued the mutineers of the British ship Bounty and restored them to their tropical home on Pitcairn Island—the historical romance made popular a few years ago by Nordhoff and Hall. The Essex Institute has the acknowledgment of the Pitcairn Island dwellers for this gallant service performed by Cap Driver under the American Flag. So you see, we've caught Old Glory up to early tricks in restoring justice beyond Hawaii.

Yet this does not end the history of Cap Driver and his treasured banner. In 1837 he grew weary of seafaring life and moved to Nashville, Tennessee, where he served for a time as provost marshal, and died there in 1887, aged 83 years.

Outspoken and choleric like most sea captains are, Cap Driver got himself into several scrapes during the early days of the Civil War. His pronounced New England sentiments furnished trouble for him, although he and his kindred may have had enough to do with rum and slave traffic afloat to render his remarks at Nashville rather inconsistent.

At any rate he sewed Old Glory onto his bed coverlet and so kept it hid during 1860 and 1861. When Buell's forces got to Nashville in 1862 they first raised a small United States ensign over the State Capitol. The next day Cap Driver toted out his much worn Old Glory, having ripped the seams that fastened it to his quilt. He asked the army officers to hoist it up on the staff in place of the smaller flag, where it remained for several weeks over the State House where sixty years or so later they honored the valiant deeds of Sergeant York of Fentress County. He too, like old Cap Driver, defended Old Glory in foreign lands.

When it comes to this theme of patriotism, I really doubt if the august Supreme Court itself could hand down an inclusive, satisfying definition that would depict the glory, the suffering, and the grimy grins which are woven into the sacred tapestry of our national life. In short, the Court might have a worse time than Sherman had in describing war politely, and not be able to make it so brief either.

Patriotism is as varied as the individual's own inherited or acquired traditions. To some it visions the theme of "my country, right or wrong." To

others it means Mayflower ancestors, antique furniture, baked beans, liberty and equality, one and inseparable. Some folks look into the glass darkly and see brotherhood-of-man, communism, distribution of income, plenty of spaghetti, and swift justice. There are some who explain it by wisecracks, and a few others like ourselves off in a corner who try to fit patriotism to befuddling modern conditions.

Patriotism is also like religion because it adapts itself to the user. Americanism to the tolerant means tolerance; to the intolerant it means revenge; to soldiers it means sacrifice and maybe medals; to traitors and schemers it means a great selfish opportunity. We have to fumble around with the word when talking with Indians and Negroes, and we need fresh injections of it even in wartime to keep us in step.

During the first fifty years of American independence the citizens had to get weaned away from Royalty and accustomed to Loyalty. Then plenty of the civilians broke away and tried to grow bigger than the Flag itself. There are even some of us yet who think this is the land of the spree and the home of the knave, and for whom there will be a day of reckoning when we polish off the enemy.

I GET pretty tired sometimes trying to weed out the false from the true patriots. Lip-service loyalty and feverish hysteria do not represent the brand of American patriotism we like to depend upon in a pinch to rally 'round the Flag.

When we stretch our stipends to pay honest debts here at home, we are being loyal to the country. When we try to live like dukes on somebody else's ducats, when we stand up at The Star-Spangled Banner and lay down on law observance—is that the kind of tradition we want to behold when the banner flies?

Sure, I think it's mighty important to know just how to arrange the Flag and display it right, and not to dishonor it with advertising or commercial propaganda. I'm for learning how to say the American Creed and I am strong for the Flag salute, but don't ever ask me to sing the National Anthem! My inherited and acquired musical and vocal scale is not up to it, yet I feel just as proud as you do when it's sung by real singers. All these technical and ritual points are well meant and quite all right with me, but still I would not bash a man down for making a mistake over Flag routine, outside the Army and Navy. I think there are deeper and finer things below the surface in this reverence for the Flag than gestures and positions and red tape.

THEN finally I think the government bosses can be perfectly frank and open with us about our taking the bad news well and facing the worst issues calmly. They don't need to keep us in suspense or leave us in the dark on issues which are not veiled in military or naval significance.

We look to the Flag as something so serene and ennobling that a few dirty cracks and poison arrows and bad spells of blues won't cause us to lose faith in its meaning or destiny. In fact, the thing that makes the Flag stand for this country with all the feeling one gets in a cathedral is that so many fellows have got tired and muddy and bruised and bloody just trudging along after it anywhere they were sent.

It isn't the joy-riding and the happy old Fourth celebrations that endear this old Flag to us. It's the seamy side of its folds that make it strong.

So, after all, this thing we call patriotism in America is something priceless and complex, something independent and inclusive, something both cooperative and personal. Under its folds we shall, I trust, see that the Flag stands for a land which remains a haven for something besides expediency and explosives.

And now I'll stop, seeing that I got more off my chest than I expected to, and you have stayed with me longer than anticipated. To the Flag and you, a salute!

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THE AMERICAN POTASH INSTITUTE

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A city girl visiting the country went to the old swimming hole and, after hanging her clothes on a nearby bush, dived in. A country lad came by and tied her clothes in a tidy knot. Emerging, the girl grabbed an old tub nearby and, placing it in front of her, accosted the lad.

"Do you know what I think?" she said furiously.

"Yes," said the lad. "You think that tub has a bottom in it, but it hasn't!"

Wanted to Be There

Tony, the office janitor, had been working faithfully at his job for several years, when he surprised his employer one day by asking for a vacation.

"We can't get along very well without you," said the boss. "You don't need a vacation. You'll only blow in your money and come back broke."

"I like to have vacation," persisted Tony. "I get married and I kinda like to be there."

The colored preacher called all of his flock together and before he started preaching, he said:

"Brothers and sisters, you know Ah's been preaching to this congregation for about fo' years now, and every year at hog-killing time, all Ah gets is pigs feet, and mo' pigs feet. Now Ah'm goin' to tell you folks som'tin'; if Ah preaches to this congregation any longer, Ah simply has got to eat higher up on dat hog!"

Irate Father (discovering his daughter and young man curled up on divan): "Mildred—what does this mean"?

"Come back in about fifteen minutes, Dad, I ought to know by then."

A boy had been taken to see the marvelous spectacle of the Grand Canyon and had been told that it was a mile straight down to where the mighty Colorado River flowed.

That night he wrote one sentence in his diary: "I spit a mile!"

A father and his small son were on a train. Across the aisle were seated two soldiers. Pointing to one of them, the boy asked:

"Daddy, what's he goin' to do?"

"Capture Hitler," the father replied.

The little boy pondered the matter for a moment, and then asked.

"Well, what's the other one going to do?"

A demure young lady walked slowly down the church aisle, clinging to the strong arm of her father. As she reached the platform before the altar, her dainty foot brushed a potted flower, upsetting it. She looked at the stilled church, then raised her large child-like eyes to the sedate face of the old minister and said: "Mister, that's a helluva place to put a lily."

Fatal typographical error! Postal to wife from vacationing husband, "Having wonderful time. Wish you were her."

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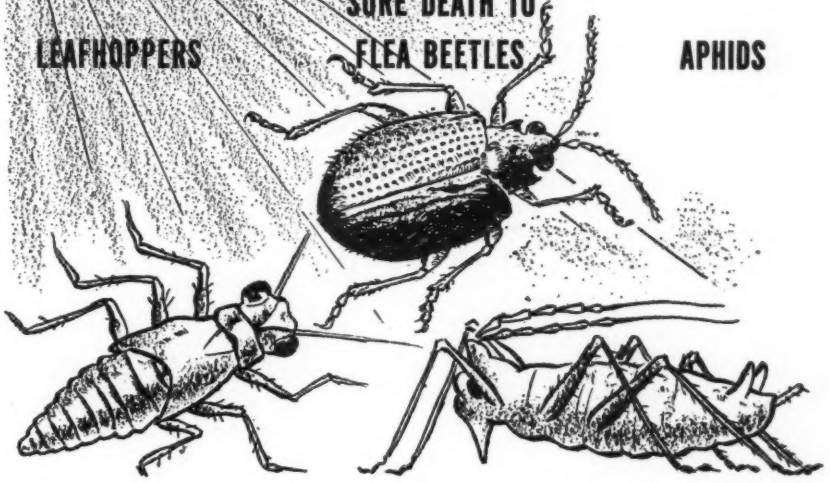

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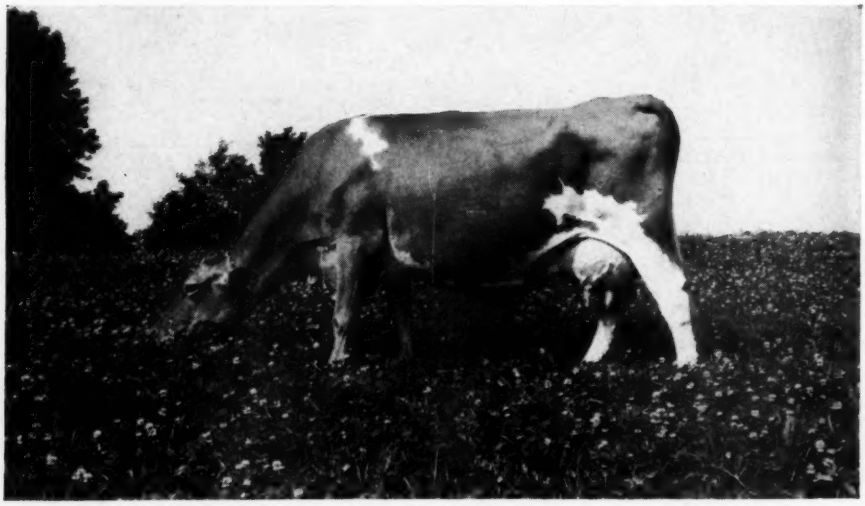

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